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SPORE-POLLEN SPECTRA OF SURFACE SAMPLES FROM *ZELKOVA* FORESTS IN THE BABANEURI RESERVATION (EAST GEORGIA)

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ABSTRACT. The results of palynological studies of subrecent surface samples in the Babaneuri Reservation are presented. All dominants of trees (except *Zelkova)* in the forest are well represented in the pollen spectra. Pollen of *Zelkova* was found only sporadically. It seems to be caused by a low pollen productivity of *Zelkova* and its bed preservation. This could be the reason why *Zelkova* is never well represented in the Tertiary pollen floras.

KEY WORDS: surface pollen spectra, *Zelkova* relict forest, East Georgia

INTRODUCTION

The present paper is a continuation of the programme devoted to the studies of recent pollen spectra of deposits in mountain regions of Georgia and Poland (Kvavadze & Stuchlik 1990, 1993). Such investigations are aimed at establishing regularities of subfossil pollen spectra formation in various orographic and climatic conditions in order to use them as a reference material in paleopalynological researches.

East Georgia, unlikethewest part of the country, is characterized by more contrusting landscapes. In lowlands the climate continentality increases, and south-east winds penetrating into this region cause aridity.

In June, 1989 during field works, the forests of the Lagodekhi and Babaneuri Reservations were investigated. A lot of surface samples were taken. In this paper we present the results of studies of *Zelkova* forests on the territory of the Babaneuri Reservation.

The Reservation is situated in the piedmont part of southern slopes of the Main Caucasian Range in North-East Georgia at the headwaters of the left bank of the Alazani river (65 km to the north-east of Tbilisi). The area of the Reservation is not large – 770 ha. It was founded in 1960 with a view to protecting the Tertiary relict *Zelkova carpinifolia* (Pall.) Dipp., whose areal in the Caucasus is represented by four sites situated apart Fig. 1

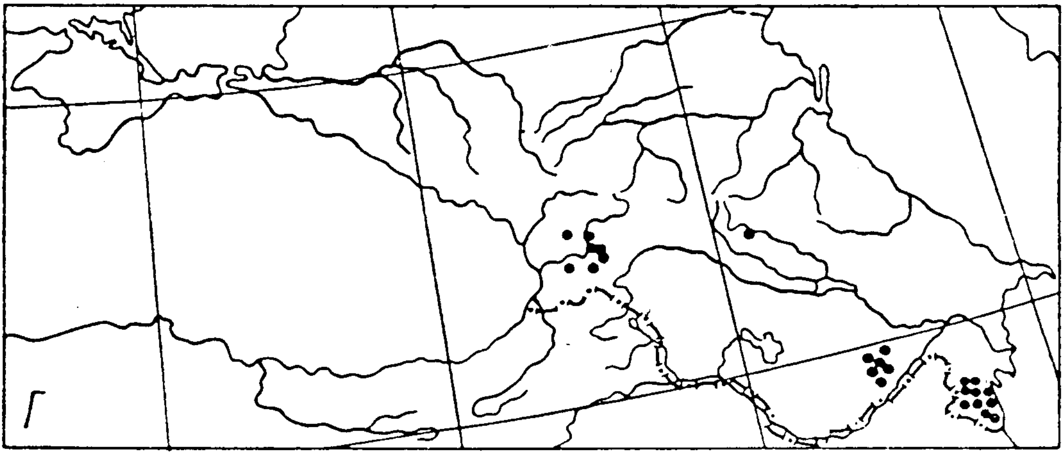

Fig. 1. Distribution of *Zelkova carpinifolia* in Georgia (after Sokolovet al. 1977)

It should also be noted that in East Georgia, Babaneuri is the only site where *Zelkova* grows. It was discovered in 1947.

The initiator of this Reservation was N. N. Ketskhoveli (Sokolov & Syrojechovskij 1990).

A BRIEF PHYSICO-GEOGRAPHICAL DESCRIPTION

The territory of the Reservation is situated at an altitude of 380–1100 m a.s.l. The relief is rather gentle, slope steepness seldom exceeding 20–25°. The mountains are mainly composed of Upper Jurassic and Cretaceous sediments (Maruashvili 1970). The climate is warm. The average annual temperarure is +12.4°; the average temperature in July is +23.7° and in January +0.5°. The absolute temperature maximum is +39°, while minimum is –24°*.

The vegetation period lasts 210 days on the average. From March to November there are no long frosts periods. The amount of precipitations per year is 914 mm, the main part of them accounts for the warm season. In this region north and west winds prevail. The wind velocity reaches its maximum in warm season (Svanidze et al. 1987). Hydrological network is very poorly developed. It is only represented by temporary water-courses. The soils in southern gentler areas are alluvial carbonate. Here meadow vegetation prevails with some elements of steppe. On the piedmont ridges there are brown forest soils. In the middle mountain belt they are replaced by brown forest soils on which oak-beech and hornbeam forests mostly grow. The whole forest massif occupies 90% of the Reservation territory. Among them the *Zelkova* forests account for 31%

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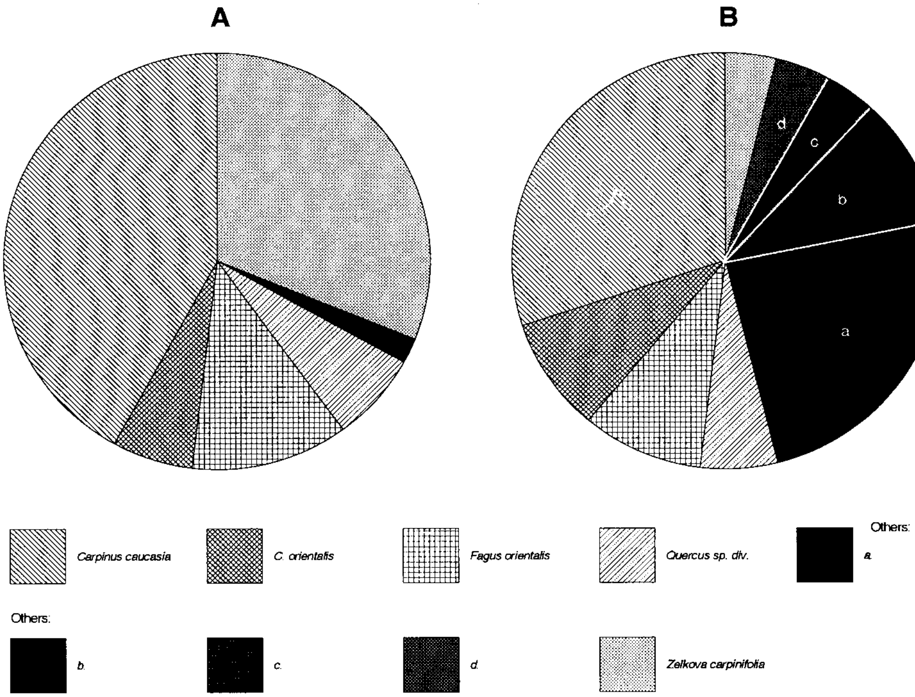
* All the climatic data are taken from the book "Spravochnik po klimatu SSSR2 (Reference book on climate in the USSR in Russian) vol. 14, 1971.



	A	B	
1. *Carpinus caucasica*	41%	30%	
2. *C. orientalis*	6%	9%	
3. *Fagus orientalis*	12%	9%	
4. *Quercus* sp. div.	7%	6%	
5. *Zelkova carpinifolia*	31%	4%	
6. Others:	2%	42%	(a. *Pinus* – 24%; b. *Alnus* – 10%; c. *Picea* – 4%; d. *Juglandaceae* – 4%)

Fig. 2. Cyclogramm of the main tree components in the forest of Babaneuri Reservation – A; and the main components in the spore-pollen spectra of surface samples – B

(208 ha) (Fig. 2). Hornbeam forests occupy a little larger area (283 ha). The beech oak and oriental hornbeam forests occupy 80 ha, 50 ha and 40 ha, respectively. The *Zelkova* forests grow at altitudes of 400–500 m.

RESULTS AND DISCUSSION

At an altitude of 420 m on the north-west slopes which steepness does not exceed 10°, we studied sample plot No. 23. On the plot there grows a mixed uneven-aged forest, with very well distinguished layers. The first layer consits of *Carpinus caucasica* and *Zelkova carpinifolia* with some admixture of *Quercus*, *Acer*, *Ulmus*, *Tilia*. The cover degree of this layer is large – 90%. The biggest of the *Zelkova* trees are 20 m high and have 1 m in diameter. As to the rest components of the forest, they are uneven-aged, though young species are prevalent. This fact implies that the forest composition, except for *Zelkova*, is of secondary origin.

The shrub layer is rich and well developed. Its covering is 40%. Here the arboreal layer constituents are predominant, among which *Zelkova carpinifolia* and *Carpinus orientalis* should be mentioned first of all. There is rather a large amount of shrubs: *Lonicera*, *Cornus*, *Phillyrea*, *Crataegus*, *Hedera*, *Smilax*, etc.

The layer of herbs is not abundant. Its coverig hardly reaches 60%. Here grasses (*Melica*, *Festuca*) and *Ajuga reptans* are the main components. Among other herbs, the following should be mentioned: *Lathyrus hirsutus*, *Asperula odorata*, *Vicia cracca*, *Primula macrocalyx*, *Orobanche* sp. etc.

Below we present a detailed description of the plot (Record), according to Braun-Blanquet principle (1951).

D a t e 10.06.1989; altitude: 420 m a.s.l.; exposition: N; slope degree: 5°; height of the trees 20 m; their diameter: 100 cm; covering of the tree layer (a) – 90%, that of the shrub layer (b) – 40%, that of the herb layer (c) – 60%.

T r e e s. *Zelkova carpinifolia* a – 2.2; b – 3.3; c – 2.2; *Carpinus caucasica* a – 2.2; b+; *C. orientalis* a – 2.2, b –1.1; *Quercus iberica* a –1.1; b +; *Fraxinus excelsior* a – 1.1, b +; *Acer laetum* a –1.1, *A. ibericum* a +; *Ulmus glabra* a – 1.1, c +; *U. suberosa* a +; *Prunus spinosa* a +; *Tilia caucasica* a – 1.1, c +.

S h r u b s. *Lonicera caprifolium* +, *L. caucasica* 1.1, *Cornus mas* +, *Hedera helix* +, *Crataegus pentagyna* +, *Smilax excelsa* 1.1, *Fagus orientalis* +, *Phillyrea* sp. +.

H e r b s. *Carex sylvatica* 1.1, *Ajuga reptans* 3.3, *Lathyrus hirsutus* 2.2, *Viola* sp. +, *Asperula odorata* 1.1, *Primula macrocalyx* 1.1, *Melica nutans* 2.2, *Paris incompleta* +, *Aristolochia* sp.+, *Orobanche* sp. 2.2, *Festuca montana* 1.1, *Vicia cracca* 1.1, *Platanthera bifolia* +.

Beyond the plot under study in the arboreal layer were noted: *Acer campestre, Alnus barbata, Celtis caucasica, Cerasus, Clematis vitalba, Corylus avelana, Cotinus coggygria, Diospyros lotos, Daphne pontica, Evonymus europea, E. verrucosa, Ilex colchica, Jasminum officinale, Ligustrum vulgare, Mespilus germanica, Paliurus spina-christi, Periploca graeca, Populus alba, P. nigra, Pterocarya pterocarpa, Rhamnus catharica, Rosa canina, Rubus caesius, Ruscus hyrcanus, Salix alba, Sambucus nigra, Sorbus, Staphyllea, Spirea hipericifolia, Svida australis, Taxus baccata, Viscum album, Vitis sylvestris*. Many of them are recognized as Tertiary relicts.

On the territory of the described plot 3 samples were taken for palynological analysis: No. 3 under *Zelkova*, No. 4 under *Quercus*, No. 5 under *Carpinus caucasica*. Beyond the plot, on a forest opening two samples were taken: Nos. 1 and 2. The material was treated and pollen diagram (Fig. 3) constructed by conventional method (Kvavadze & Stuchlik 1991). The pollen preservation in samples Nos. 3, 4, 5 is rather good, however, in samples Nos. 1, 2 there are a lot of mineral particles; the pollen grains are corroded and the pollen concentration is much lower.

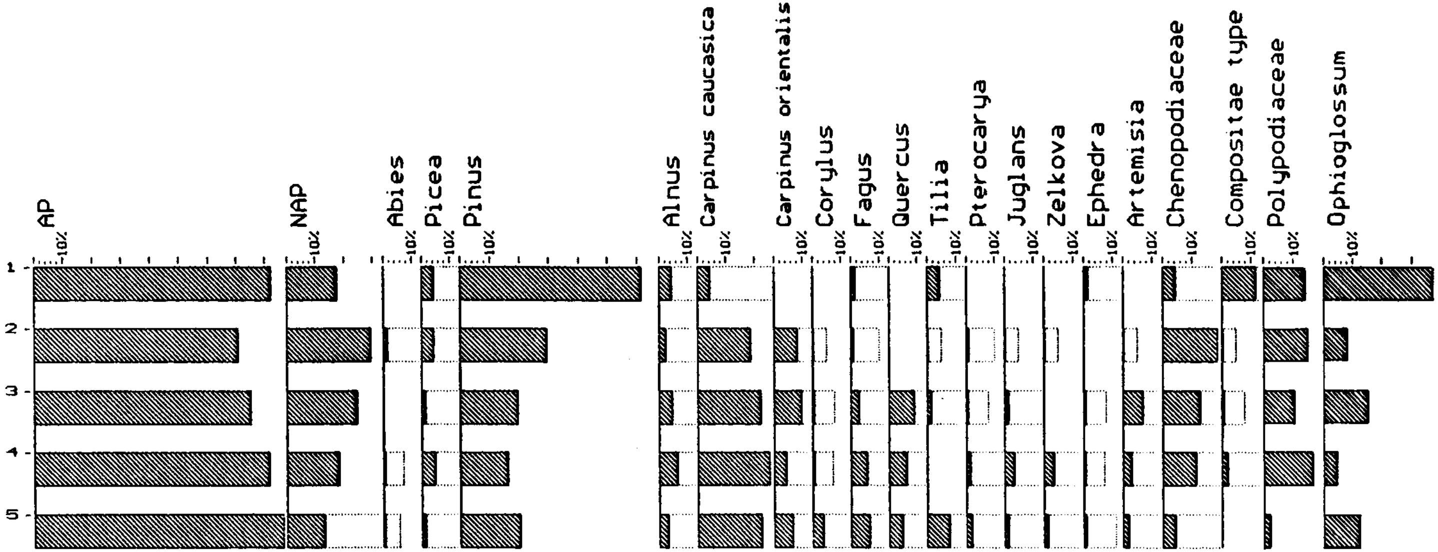


Fig. 3. Spore-pollen diagram od surface samples from the Babaneuri Reservation

Unfortunately, the presence of *Zelkova* in the pollen spectra is reflected very poorly. Only in three samples taken just under tree crowns either single or from 3 to 5 pollen-grains were found which corresponds to 1–3% among arboreal plants (Fig. 3).

The pollen spectra as a whole are characterized by prevalence of arboreal pollen (AP – up to 74%). Sporiferous species content is larger than that of herbs. It varies from 15 to 52%. In the group of arboreal plants, among conifers the pollen of *Pinus* amounts up to 33–28%, while that of *Picea* does not exceed 4% *Abies* is found in the form of single grains. All the pollen of conifers is from a long distant transport. Among broad leaved trees *Carpinus* and *Carpinus orientalis* are prevalent corresponding to 20% and 6–7%, respectively. There is rather large amount of *Alnus* and *Fagus* pollen. In the last three samples 3, 4, 5, there is a lot of *Quercus* pollen, while in samples 1 and 2 it is not found at all. This is most probably due to poor preservation of the pollen in bottom samples. For the same reason, in the spectra of samples 1, 2, there is a lot of *Pinus* pollen and little pollen of broad-leaved species. Here the soils are lumpy with smaller amount of humus, since they were taken on a steep slope where intensive ablation takes places. The pollen of *Junglans* and *Pterocarya* are brought here from neighbouring areas. The pollen of *Betula*, *Fraxinus*, *Ulmus* is present as single grains. As to shrubs, the pollen of *Ephedra* brought from the forest-steppe zone is mentioned in large amounts. There is also some pollen of *Corylus* and *Hedera.* Among herbs the main role is played by *Chenopodiaceae* and *Artemisia* which do not grow here, but are brought from ruderal and agricultural areas. However, the local herbs are reflected in the spectra almost without an exception. They are: *Carex, Gramineae, Compositae, Cruciferae, Caryophyllaceae, Geraniaceae, Umbelliferae.* As a result of long distant transport there appears the pollen of *Cerealia.* Sporiferous species are presented in large amounts, though they do not grow on the plot under study. These are mostly monolete spores of ferns. There are also spores of *Ophioglossum*, *Lycopodium* and *Pteridium* found in the form of single spores.

The comparison of the pollen spectra with the vegetation composition shows that apart from *Zelkova*, the role of *Prunus, Acer, Crataegus, Fraxinus, Lonicera, Cornus* is poorly reflected in the spectra.

This seems to be caused not only by unsatisfactory pollen preservation conditions in thin soils, but also by the features of the pollen itself. In the conditions of humid climate of West Georgia and in the areas of intensively developed humus horizon the pollen of the mentioned species is also found rather seldom (Stuchlik & Kvavadze 1987). An exception to this is *Lonicera* which is represented in rather a great amount in many cases (Kvavadze & Rukhadze 1989).

As shown on Fig. 2, the correlation of the percentage of the Reservation forets composition with a similar composition of the elements of the spectrum demontrates that a half of the arboreal pollen is from a long or short distant transport. The same holds for the composition of herbs. As to the sporiferous species, all of them are brought in. Nevertheless, the local vegetation, aside from *Zelkova*, is reflected quite adequately in the spectra. Thus, for instance, the first dominant in both cases is *Carpinus*. *Quercus* and *Fagus* are characterized by almost equal proportion in the forest and in the spectra.

As to the participation of *Zelkova* in the pollen spectra, it seems that its pollen either cannot be preserved in soils or the pollen productivity of this Tertiary relict is low. Probably the recent years were not favourable for *Zelkova* blooming and fruiting. According to Gogichaishvili (1988), in the samples taken in Babaneuri 20–30 years ago the content of *Zelkova* in the spectra was higher (from 10 to 20%) than nowadays. However, our assumption of reduced polliniferous ability and poor preservation of *Zelkova* in fossilization are supported by the facts that on the territory of Georgia, too, in fossil spectra of the Middle Miocene and Pliocene-Pleistocene periods in deposits of any genesis there is little pollen of this rare plant, much less than, for instance, that of *Ulmus* (Shatilova & Ramishvili 1990, Mamatsashvili 1991). The content of this pollen generally does not exceed 5–10%.

CONCLUSION

The investigation of the forest composition of the Babaneuri Resevation and its comparison with the soil pollen spectra have shown rather interesting regularities in spore-pollen spectra formation. Almost all dominants and subdominants of the forest are reflected in the pollen spectra except for *Zelkova carpinifolia* whose role is reduced by a factor of several tens (Fig. 2). It is not quite clear to us what it is caused by. Nonetheless, we try to explain this fact by two reasons: low polliniferous ability of *Zelkova* and poor preservation of its pollen during fossilization. This assumption relies upon fossil pollen spectra of the Middle-Miocene and Pliocene-Pleistocene age, in which the pollen content of *Zelkova* is, as a rule negligibly small. Therefore, when reconstructing vegetation of the past epochs, it should be borne in mind that single findings of the pollen of this Tertiary relict play a considerable role of this plant in phytocenoses of regions under study.

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